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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/724,848	12/01/2003	Alan Charles Cooper	06489 USA	2180

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EXAMINER

STADLER, REBECCA M

ART UNIT	PAPER NUMBER
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1754

DATE MAILED: 07/10/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/724,848	Applicant(s) COOPER ET AL.	
	Examiner Rebecca M. Stadler	Art Unit 1754	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 March 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6, 9-11, 15-24, 37-45, 47 and 48 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6, 9-11, 15-24, 37-45, and 47-48 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 01 December 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>4/2/04 & 7/25/05</u> . | 6) <input type="checkbox"/> Other: _____ |

Response to Arguments

Applicant's arguments with respect to claims 1-7, 12-14, and 25-32 have been considered but are moot in view of the new ground(s) of rejection.

The Sudan was available online 3 September 2003. Evidence of this date is submitted with this office action.

Regarding applicant's argument that the nanotubes of Sudan are too large, the claimed range of nanotube diameters overlap or are so close to that of Sudan that a prima facie case of obviousness has been made (see discussion below). Further, Sudan discloses nanotubes that range from 0.7 nm to 1.2 nm. It is possible that 75% of the nanotubes are 0.7 nm in a diameter, while the remaining nanotubes have a diameter of .08 nm. If applicant is suggesting unexpected results, then applicant is invited to submit evidence of unexpected results. Of note, decreasing the carbon nanotube diameter would be expected to increase the heat of adsorption because of the larger curvature of the nanotube resulting from the smaller diameter.

As to applicant's argument that Sudan and USP '538 are not combinable because one teaches that the presence of metal does not affect the ability to store hydrogen, while the other discloses that it is desirable, USP '538 was not relied upon for the presence or lack of presence of metal. Nor was it relied upon for teaching that metal has an impact or does not have an impact on the ability to store hydrogen. USP '538 was relied upon for its teaching of carbon nanotube bundles. Of note, the nanotubes of Sudan likely bundle anyway because they are single-walled carbon nanotubes, which are known to inherently bundle due to van der Waals forces. USP '538 was also relied upon for its teaching of PSA and TSA for the storage and release of hydrogen. Again, this reference was not relied upon for its teaching whether metal is present or not or whether it affects hydrogen storage. Ultimately, USP '538 discloses that bundles of single-walled carbon nanotubes (with or without the presence of metal) are useful for storing and releasing hydrogen by a PSA or TSA process. Finally, applicant argues that the references cannot be combined because they employ distinct hydrogen storage materials. This argument is untenable because both employ carbon nanotubes to store hydrogen. Both

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structures contain metal because a metal serves as the catalyst in the production process leaving behind trace amounts of metal. Overall, both hydrogen storage materials are carbon nanotubes with a small amount of metal. As such, the references are combinable. Of note, the Examiner could not find the teaching in '538 that adding metal is desirable in order to intercalate the nanonstructure.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-6, 9-11, 15-24, 37-45, 47-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over the Sudan article in view of Rodriguez 6,159,538.

As to claims 1-6, the Sudan article discloses a process for physisorption of hydrogen with single-walled carbon nanotubes with diameters of 0.7-1.2 nm and lengths of 2-20 μm (or 20-200nm) (see section 2.1, lines 10-11). Since all of the nanotubes are less than or equal to 200 nm, a majority of them have lengths less than or equal to 1,000 nm as in claim 1. This is true for claims 2, 3, and 5 where the average length is less than or equal to 500 nm, 200 nm and 500 nm respectively. As to the diameters, the article does not disclose whether the majority of carbon nanotubes have diameters in the range of 0.4-0.8 nm as in claim 1. Further, the reference does not disclose whether greater than 75% of the carbon nanotubes have diameters in the range of 0.4-0.8 nm. Where, as here, the reference discloses all the limitations of a claim except a property or function, and the examiner cannot determine whether or not the reference inherently possesses properties which anticipate or render obvious the claimed invention, the burden of proof is shifted to the applicant, as in In re Fitzgerald, 619 F.2d 67, 205 USPQ 594 (CCPA 1980).

The Sudan reference does not disclose whether there are bundles of single wall carbon nanotubes. However, Rodriguez '538 discloses layers of carbon nanostructures (see abstract lines 1-2). This reference discloses that single walled carbon nanotubes are a preferred carbon nanostructure (see column 3, lines 35-37). As can be seen by column 2, lines 49-51, some of the carbon nanotubes do fall within the claimed diameter range, evincing that carbon nanotubes having this small diameter are known to be useful for hydrogen sorption. As such, it would have been obvious to one of ordinary skill in the art at the time of this invention to combine the carbon nanotube hydrogen storage material of Sudan with the bundling of the carbon nanotubes in Rodriguez '538 in order to provide enough nanotubes to adsorb an appreciable amount of hydrogen. As to claims 9 and 10, duplication of the carbon nanotube parts is an obvious expedient and has no patentable weight. See, e.g., In re Harza, 124 U.S.P.Q. 378 (CCPA 1960).

Finally, heat of hydrogen adsorption is an inherent property. As such, any material meeting the limitations of claim 1, will have heat of hydrogen adsorption values within the ranges claimed.

As to claim 48, Sudan discloses a process for physisorption of hydrogen with single-walled carbon nanotubes with diameters of 0.7-1.2 nm and lengths of 2-20 μm (or 20-200nm) (see section 2.1, lines 10-11). This range meets the endpoint of the claimed range. If this does not meet the entire claimed range, it is so close that it is obvious that the properties of the Sudan nanotubes would be the same as the properties of the present graphite. See, e.g., Titanium Metals Corp. v. Banner, 778 F.2d 775, 227 U.S.P.Q. 773 (Fed. Cir. 1985).

As to claim 11, the interstice distance of the carbon nanostructure bundles is preferably between 0.335 and 0.40 nm (see '538 column 2, lines 45-47).

As to the process for storage and release of hydrogen of claims 15-18, 24, 37-40, and 47, Rodriguez '538 changes the temperature and/or pressure to affect whether the hydrogen is being released or stored (see column 9, lines 1-39). As such, the process of Rodriguez can be pressure swing adsorption, temperature swing adsorption, or pressure and temperature swing adsorption, thereby meeting the limitations of claims 15 and 37. As to claims 16, 17, 38 and 39, Rodriguez '538 does not specifically recite the steps of increasing the pressure to the sorption pressure and reducing the sorption pressure to the desorption pressure, nor the steps of decreasing the temperature to the sorption temperature and increasing the sorption temperature to the desorption pressure. However, these steps appear to be inherent as disclosed in column 9, lines 1-39. The objective of the Rodriguez process is to store and then release hydrogen by using an adsorption process, which changes the temperature and pressure. As such, it is axiomatic that the claimed steps are being performed in Rodriguez '538. As to claims 18 and 40, no difference is seen between these steps and the steps of claims 17 and 39. As above, the heat of hydrogen adsorption is an inherent property.

As to claims 19, 20, 41, and 42, Rodriguez '538 discloses a sorption pressure of 1,000 psig to 3,000 psig (see column 9, lines 4-5), which overlaps with the claimed sorption pressure

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ranges. Although Rodriguez '538 does not disclose the desorption pressure, since the sorption pressure ranges overlap, it is expected that the desorption pressure ranges would overlap.

As to claims 21, 22, 43, and 44, Rodriguez '358 discloses sorption temperatures of 22°C through 400°C (see column 9, lines 32-35), which overlap with the claimed sorption temperature ranges. Although Rodriguez '538 does not disclose the desorption temperature, since the sorption temperature ranges overlap, it is expected that the desorption temperature ranges would overlap.

As to claims 23 and 45, Rodriguez '358 discloses the claimed pressure and temperature sorption ranges and is expected to possess the claimed pressure and temperature desorption ranges.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).


A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rebecca M. Stadler whose telephone number is 571-272-5956.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman can be reached on 571-272-1358. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

rms


WAYNE A. LANGEL
PRIMARY EXAMINER